round in each of the guns, using the driving rings marked A, B, and C. As it would be useless to attempt to draw general conclusions from single rounds, and as in guns of the calibre experimented with the difference between the driving rings is not very marked, I have treated the series as if all the rounds had been fired with the same driving ring; the results are given in Table IX.

Table IX.—Results of Experiments with Cordite.

Nature of rifling.	Muzzle velocities.	Muzzle energies.	Mean muzzle velocities.	Mean muzzle energies.
	ft.-secs.	ft.-tons.	ft.-secs.	ft.-tons.
No twist	2177 2171 2194	1479 1476 1509	2181	1488
Uniform rifling	2160 2161 2172	1461 1462 1477	2164	1467
Parabolic rifling......	2156 2152 2157	1455 1450 1457	2155	1454

From the cordite experiments, it follows that the loss of energy due to the uniform rifling is 21 ft.-tons, or 1·43 per cent., and to the parabolic rifling 34 ft.-tons, or 2·3 per cent.: the coefficient of friction deduced from the loss of energy with the uniform rifling being 0·199, or nearly the same value as was given in Table VIII.

III. "On the Thermal Conductivities of Crystals and other Bad Conductors." By CHARLES H. LEES, M.Sc., late Bishop Berkeley Fellow at the Owens College, Manchester. Communicated by Professor ARTHUR SCHUSTER, F.R.S. Received January 22, 1892.

(Abstract.)

The author commences by pointing out the great differences between the results obtained in 1879 by G. Forbes for the conductivities of quartz in different directions and those obtained in 1883 by Tuschmidt. He then refers to Kundt's discovery, that the metals stand in the same order as conductors, and as to the velocity of propagation of light through them, and mentions that his

experiments were originally intended to furnish data for a similar comparison for crystals, but that their object has been extended.

After some preliminary experiments, he adopted the "divided bar" method, which consists in placing a disc of the material the conductivity of which is required, between the ends of two bars of metal placed coaxially, heating one end of the combination, and observing, by means of thermo-junctions applied to the bars, the distribution of temperature along them, first, with the disc in position, second, with the bars in contact without the disc. When the conductivity of the bar is known, these observations suffice to determine that of the disc.

The bars used were 1·9 cm. diameter, and about 34 cm. long. The ends which came in contact with the discs were amalgamated, as this was found to be the best method of securing good contacts. These bars were suspended horizontally in a frame, by means of strings passing over adjusting screws, which enabled the bars to be set accurately in the required position. The temperatures were found by means of a copper-platinum-silver junction applied to points along the bars, at which small conical holes about 0·5 mm. diameter, containing mercury, were placed. This junction was in circuit with a galvanometer, and the circuit was so arranged that its resistance could be found by a modification of Thomson's bridge method.

The conductivity of the brass bar was determined before cutting, by the method—due to Forbes—of determining the loss of heat from the surface by allowing the bar to cool and observing the change of temperature with time, and then observing the steady distribution of temperature along the bar when heated at one end.

The author shows that change of both the "internal" and "external" conductivities with temperature must be taken into account in the equation for the distribution of temperature. He takes each to be a linear function of the temperature, and finds finally the conductivity of the bar to be 0·27 c.g.s. unit, and to increase slightly with the temperature.

The discs used were of the same diameter as the bar, and were of various thicknesses, in order to make the distribution of temperature throughout the bars nearly the same in each case.

The following are the results obtained, the conductivities of a few other bodies being given, in order to show the positions of the bodies experimented on amongst conductors generally. No relation of the kind found by Kundt for metals seems to hold for the crystals experimented on:—

	c.g.s. units.	
Copper	—	0·7 to 0·8 (Lorenz, &c.).
Brass	0·27	0·25 to 0·3 ,,
Bismuth	—	0·017 ,,
Mercury	—	0·018 Ångström.
Crown glass	0·0024	0·0016 (H. Meyer).
Flint glass	0·0020	0·0014 ,,
Glass	—	0·0021 (Peclet). 0·0005 (G. Forbes).
Rock salt	0·014	0·016 (Tuschmidt).
Quartz along axis	0·030	0·026 (Tuschmidt). 0·001 (G. Forbes).
,, perpendicular to axis	0·016	0·004 ,, 0·016 (Tuschmidt).
Iceland spar along axis	0·010	0·016 ,,
,, perpendicular to axis	0·0084	0·008 ,,
Mica perpendicular to cleavage	0·0016	
White marble	0·0071	0·007 (Peclet). 0·001 (G. Forbes).
Slate	0·0047	0·0008 ,,
Water	—	0·0015 (Winkelmann).
Glycerine	—	0·0007 ,,
Olive oil	—	0·0004 (G. Weber).
Shellac	0·00060	
Paraffin	0·00061	0·0001 (G. Forbes).
Pure rubber	0·00038	0·00009 ,, 0·0005 (Peclet).
Sulphur	0·00045	
Ebonite	0·00040	0·00008 (G. Forbes).
Gutta percha	0·00046	
Paper	0·00031	
Asbestos paper	0·0006	
Mahogany	0·00047	
Walnut	0·00036	
Cork	0·00013	
Silk	0·00022	
Cotton	0·00055	
Flannel	0·00023	

IV. "On the Mechanical Stretching of Liquids: an Experimental Determination of the Volume-Extensibility of Ethyl Alcohol." By A. M. WORTHINGTON, M.A. Communicated by Professor POYNTING, F.R.S. Received February 1, 1892.

(Abstract.)

After adverting to the three known methods of subjecting a liquid to tension, viz., (i) the method of the inverted barometer, (ii) the